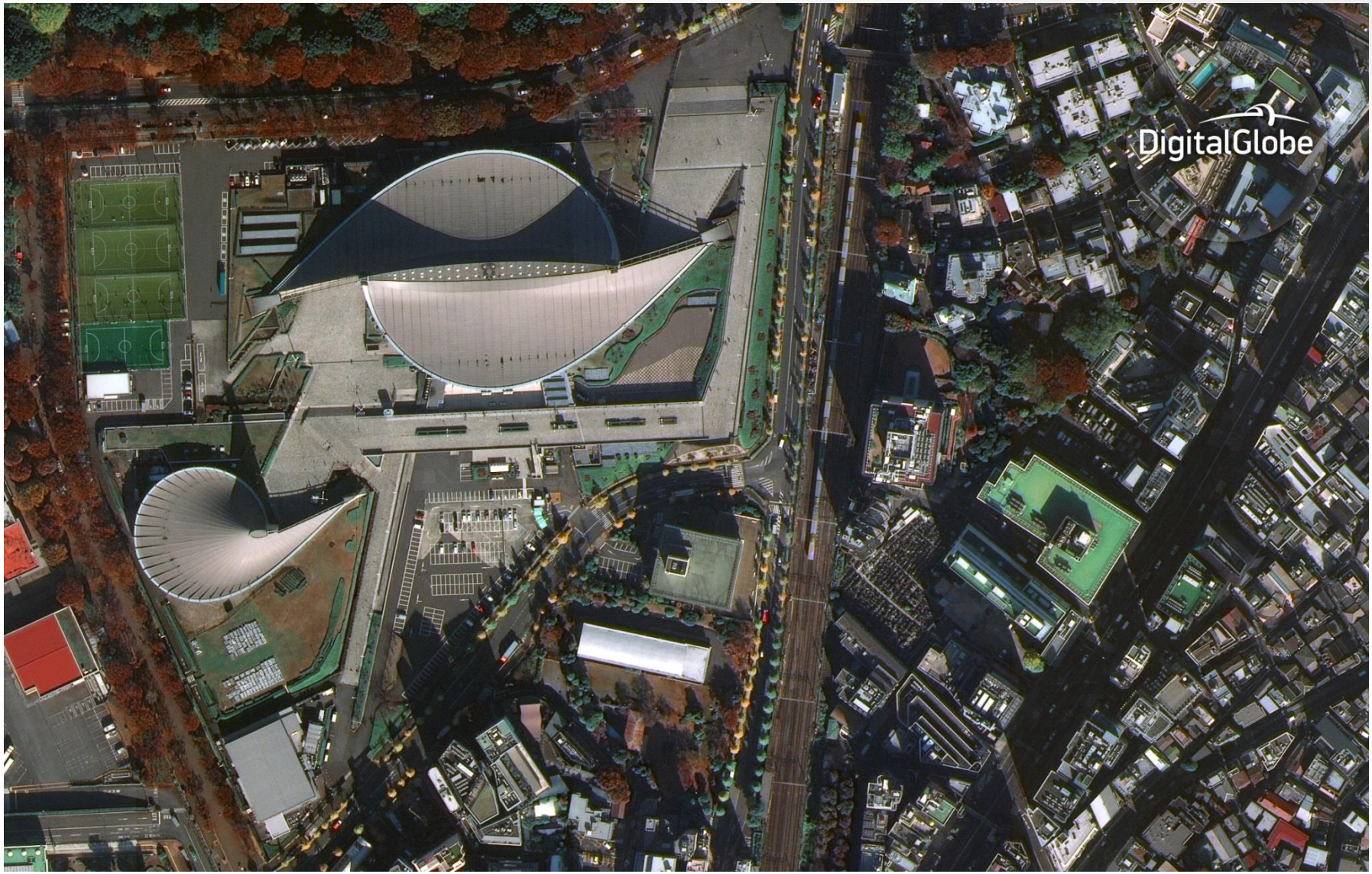
DigitalGlobe Satellite and Product Overview

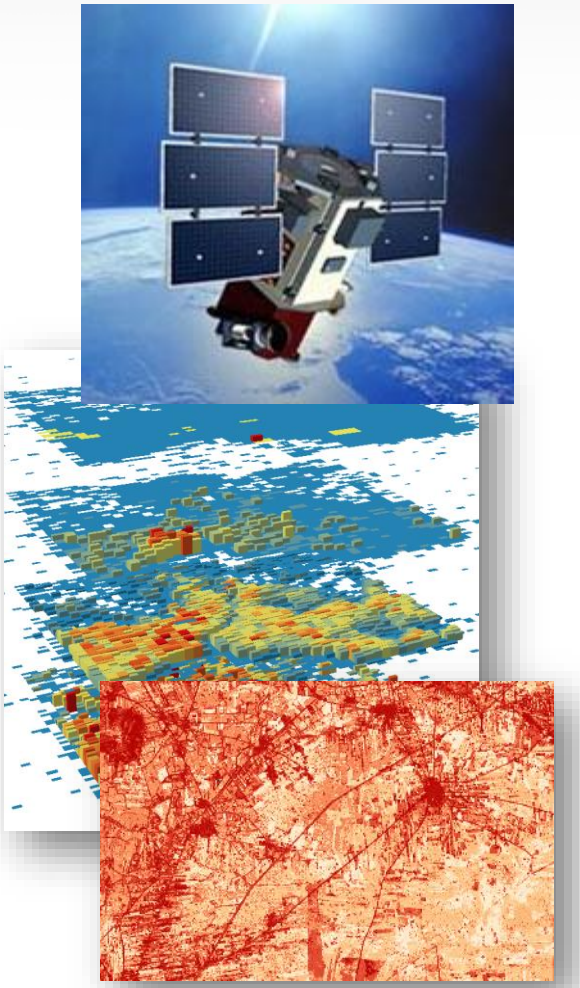
JACIE Workshop – September 2017



DigitalGlobe: What We Do

DigitalGlobe…

- **Collects the best commercial satellite images of the earth in the world**
  - 5 satellites capturing imagery at true 30-50 cm resolution with exceptional positional accuracy
  - Up to 16 bands of V/NIR and SWIR spectral data + image-enhancing CAVIS
  - 90+ PB of imagery back to 1999, 70 TB of new imagery collected each day
  - Future DG constellation (Scout/Legion/WV-150) will further diversify our capabilities
- **Provides offline imagery and hosted online subscriptions via DG Cloud Services**
- ***GBDx Platform -*** for exploiting full spectral imagery + OS + 3rd party data



DigitalGlobe: What We Do (cont.)

DigitalGlobe…

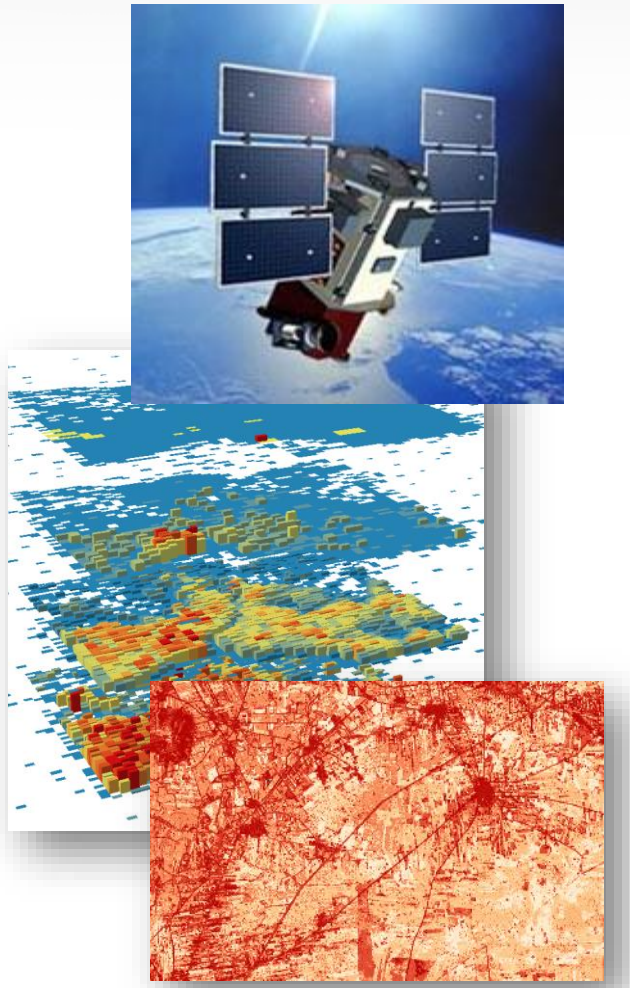
- **Provides adjacent imagery and data processing options**
  - DigitalGlobe Radiant – New Services /Analytic Branch of DigitalGlobe
  - Combining with MDA soon adding satellite and radar capabilities
  - Variety of High Accuracy Global Elevation Products – (3D, DSM, DTM, Point Cloud , etc.)
  - Tomnod / GeoHive crowdsourcing
  - Value-added information and analytic product offerings

…in order to…

Create and maintain a digital inventory of the Earth

…to then…

Provide multi-INT, predictive analysis to answer specific customer questions



DigitalGlobe's 5-Satellite Constellation

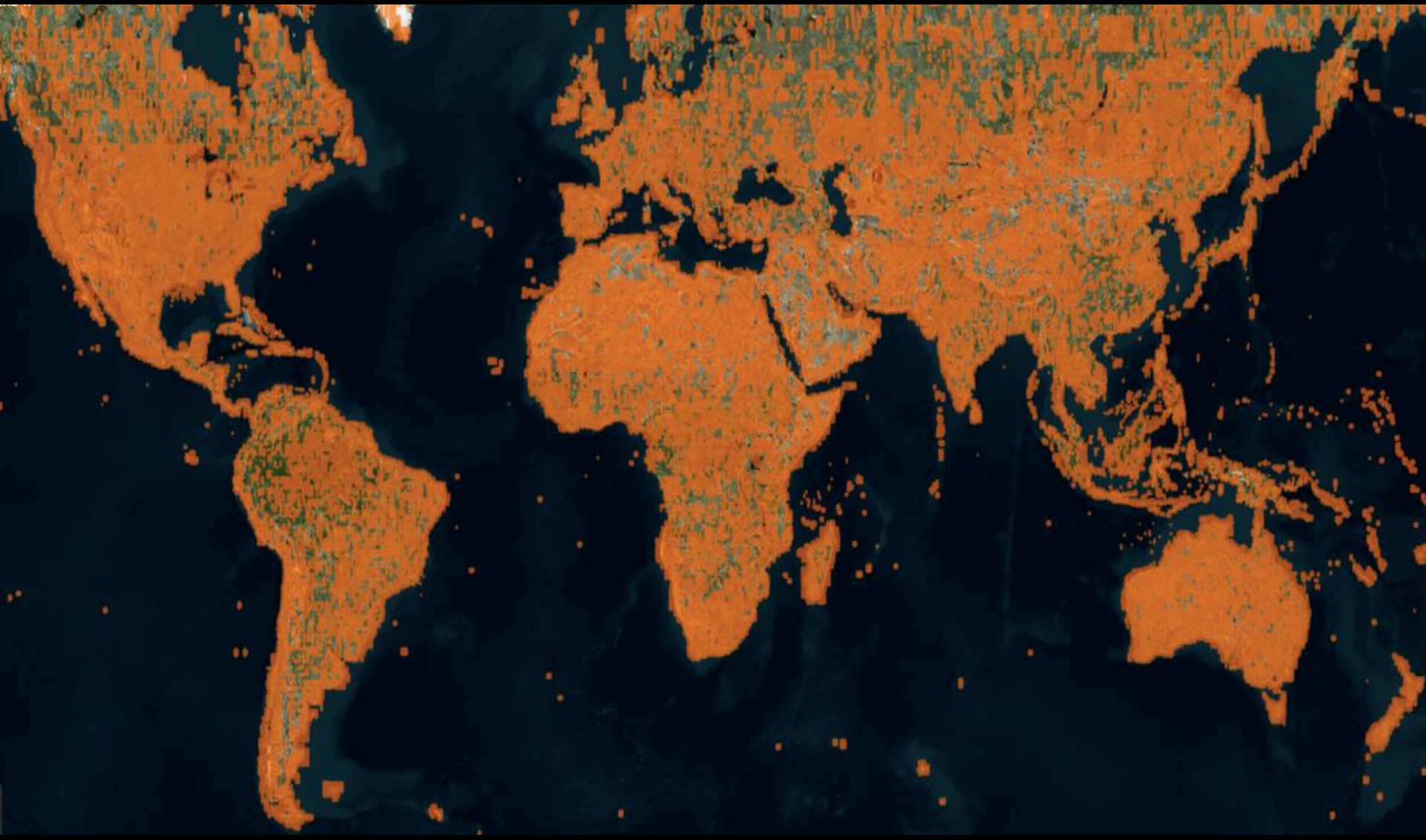
~4,000,000 km² collected EVERY DAY

13,200,000,000,000 pixels

All True 30-50 cm Spatial Resolution
Multi- and Super-Spectral Capabilities

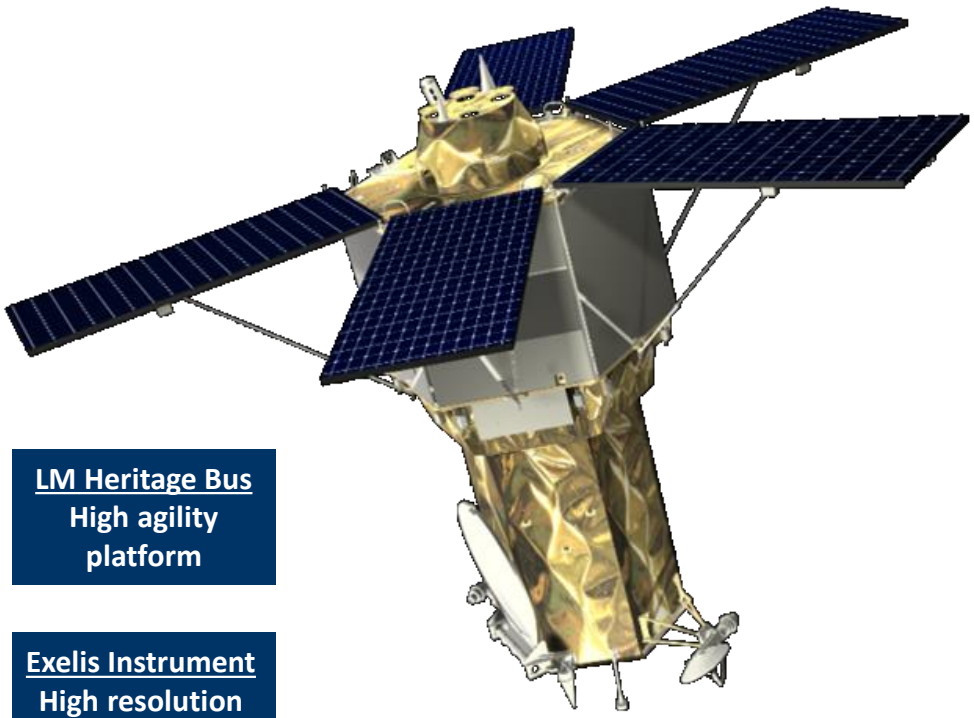
Last 3 Days

Last 14 Days



Last 3 Months

WorldView-4 – Capability Overview



LM Heritage Bus
High agility platform

Exelis Instrument
High resolution panchromatic + 4 Multispectral bands

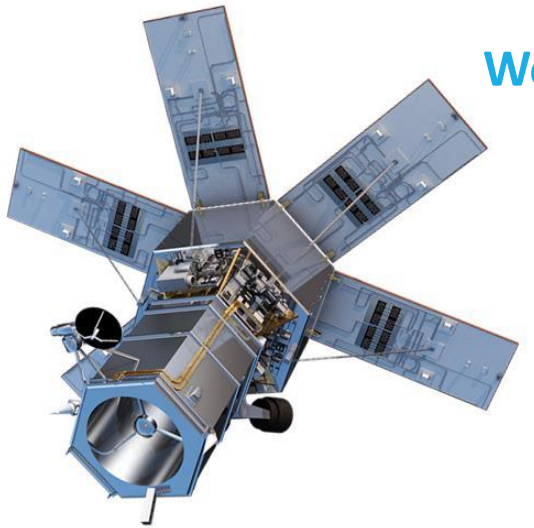
Orbit:	617 km, 1:30 pm sun sync
Resolution /	0.31 m / Panchromatic
Spectral bands:	1.24 m / 4 Multispectral
Nadir swath:	13.1 km
Line rates:	12k/3k lps
	20k/5K lps
	24k w/MS aggregated in-track
Global capacity:	640,000 sq km/day
Geolocation spec:	5.0 m CE90 (w/o GCPs)
Design life:	7 years
Expected life:	10-12 years
Propellant life:	15-50 years for 770-500 km
Reliability:	Ps ≥ 0.53 @7 years
Mass:	2510 kg (454 kg propellant)
Array / battery:	3.75 kW / 312 Ahr
Image storage:	3.2 Tbits
Image downlink:	800 Mbps (695 + EDAC) Simultaneous w/imaging

WorldView-4 more than doubles our 30cm capacity

- WorldView-4 collections are ramping to build an Archive for customer ordering

By flying in tandem “1 + 1 = more than 2”

WorldView-3



WorldView-4

WorldView-4 frees up WorldView-3 for additional SWIR collections

Our Future DG Constellation Will Diversify our Capabilities

Preliminary capabilities to be refined with customer and vendor input

Scout

- Constellation developed via Joint Venture with TAQNIA Space & KACST
- 6 spacecraft on orbit in 2018/19 timeframe
- ~80cm ground sampling distance (GSD)
- Mid-latitude orbits (tbd)

Legion

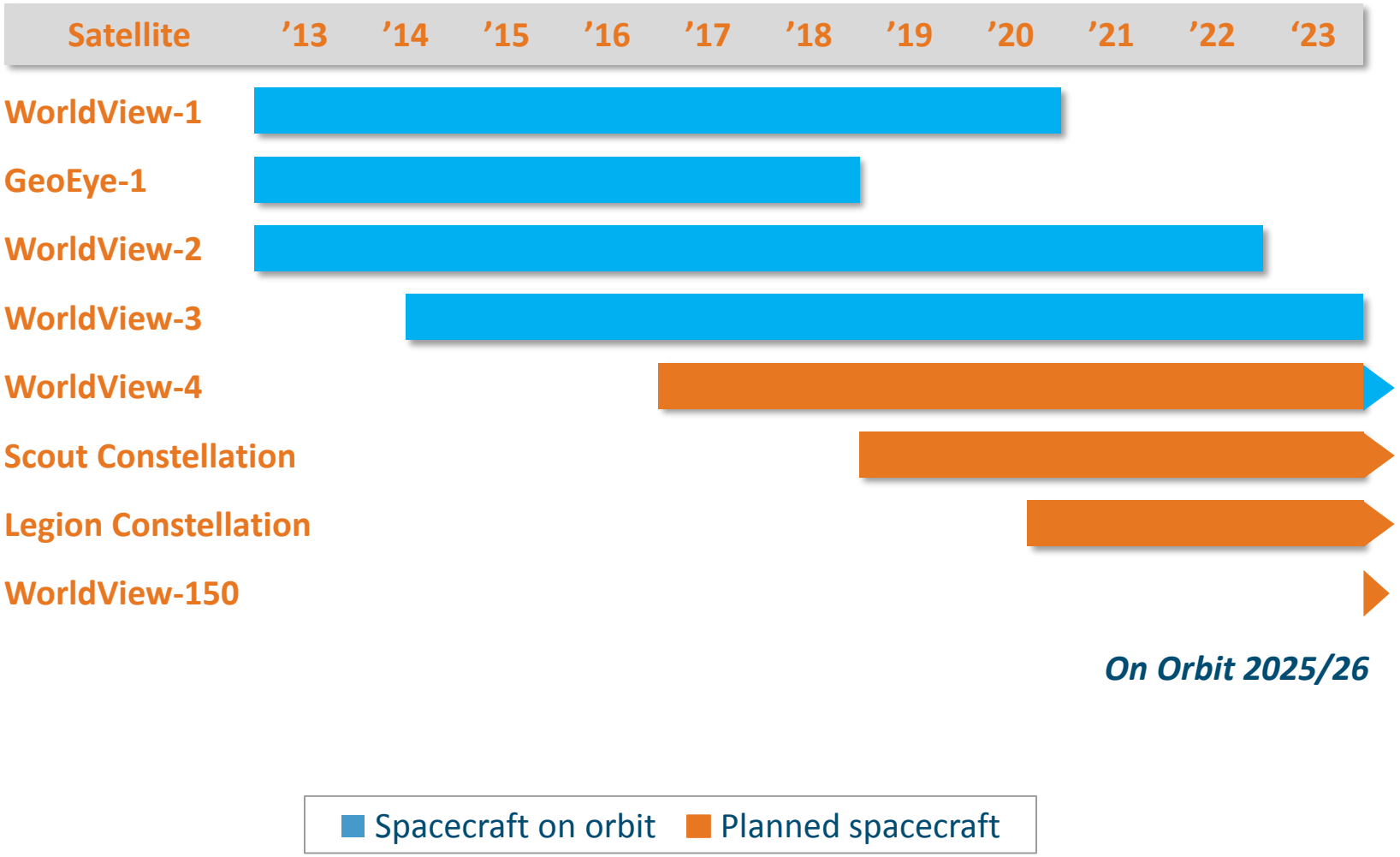
- Will replenish WorldView-1/2
- 6 spacecraft on orbit in 2020/21 timeframe
- ~35-50cm GSD
- Mix of sun-synchronous and mid-latitude orbits

WorldView-150

- Will replenish WorldView-3/4
- 1-2 spacecraft estimated to orbit in 2025/26 timeframe
- ~30cm GSD
- Sun-synchronous orbit (tbd)

Emerging view; final specifications to be refined.

Our DG Constellation Roadmap Will Extend Our Industry Leadership Well into the Next Decade

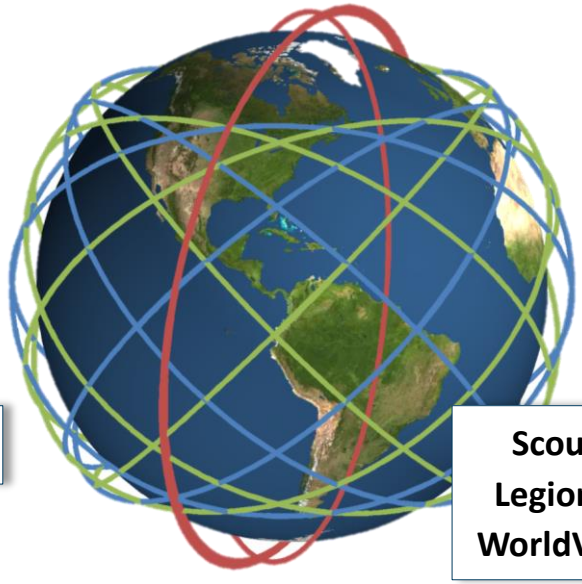


Scout and Legion will be on Mid-Latitude Orbits Which will Significantly Enhance our Revisit Capabilities

Current WorldView constellation is in sun-sync orbits

WorldView Orbit – red

Future constellation mixes sun-sync and mid-latitude orbits for greater revisit

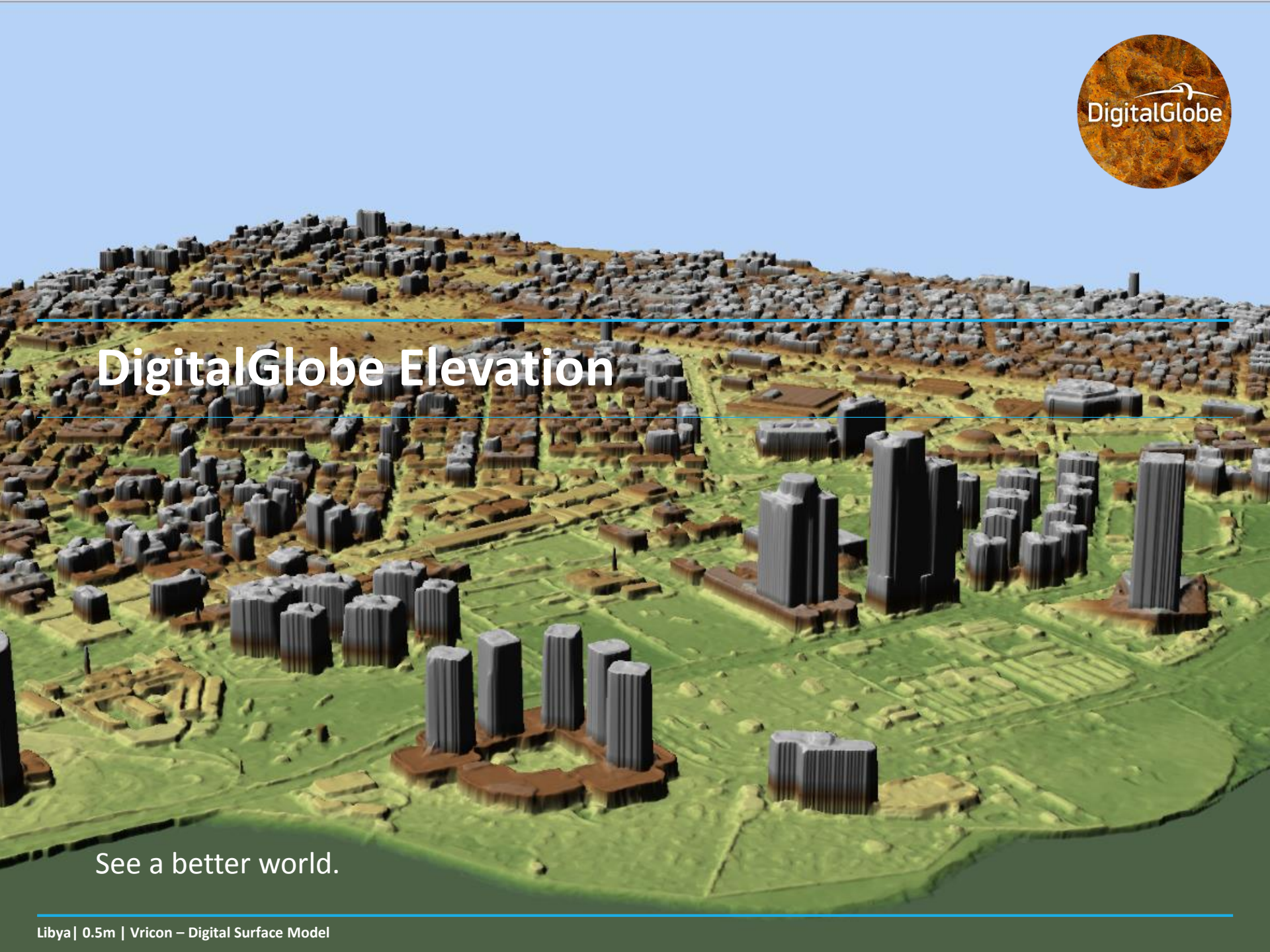


Scout Orbit – blue
Legion Orbit – green
WorldView Orbit – red

With Scout + Legion, revisit improves by more than 10x

Orbit tracks shown are a preliminary illustration of Scout and Legion at mid-lat orbits, final specifications are yet to be defined.

DigitalGlobe Elevation

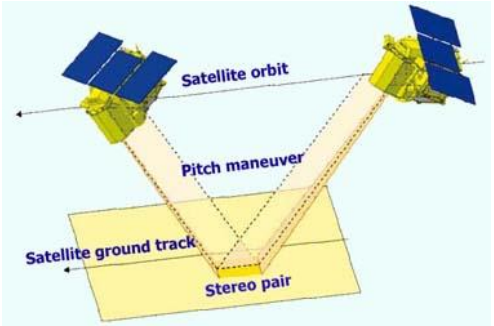


See a better world.

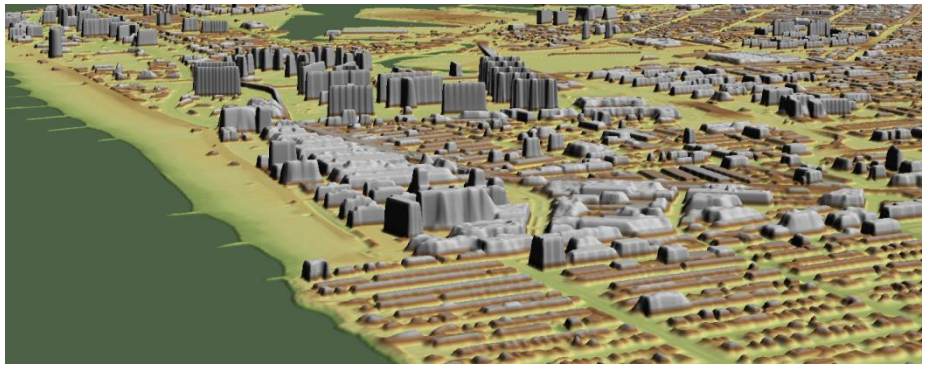
Libya| 0.5m | Vricon – Digital Surface Model

DigitalGlobe's Elevation Suite

1. **Traditional Stereo Imagery** – DIY Elevation



2. **Advanced Elevation Series (AES)** – Full service Project Specific Digital Elevation Models



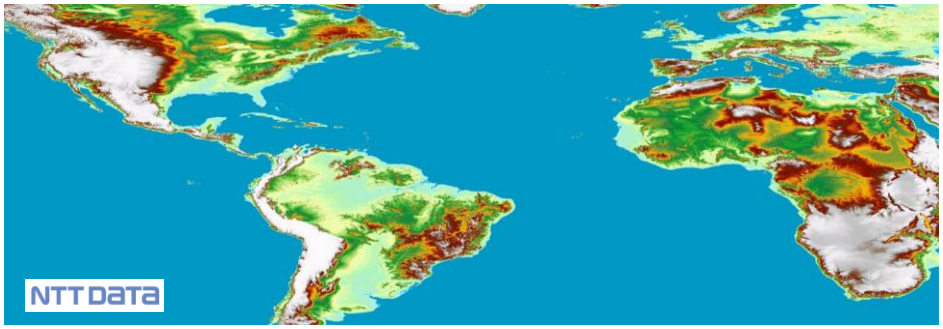
3. **Vricon Wide area Rapid Delivery 3D and Elevation** – Mutiview Photogrammetry Derived from Archive

DigitalGlobe's Elevation Suite

NEW!

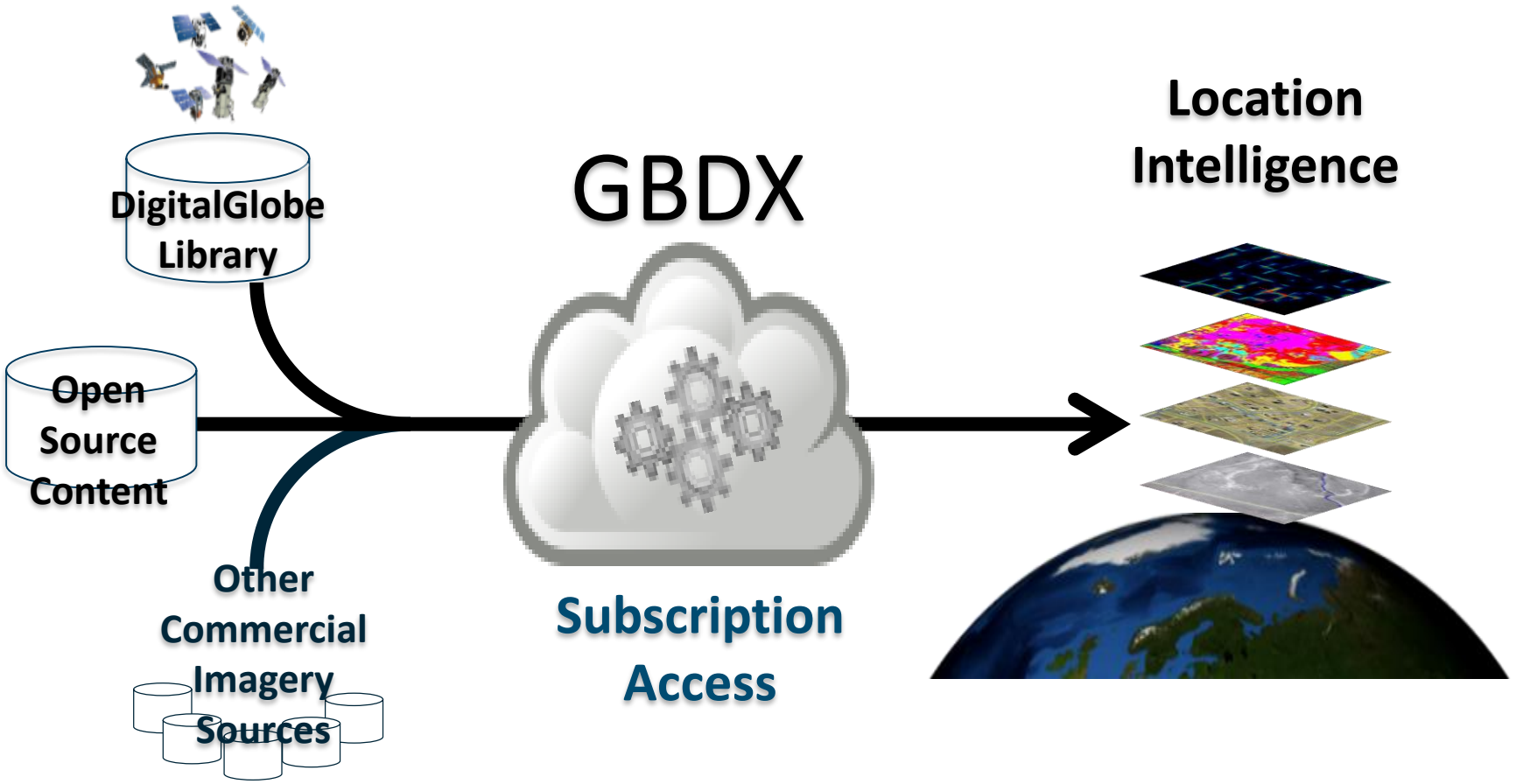
4 **NTT Advanced World Elevation (AW3D)** – 'Off the Shelf' 5m Global Elevation Models

& High-Res Enhanced DSMs/DTMs globally available at 50cm, 1m and 2m resolutions



The Geospatial Big Data Platform ("GBDX")

Bring innovation & compute to the data…



…to extract location intelligence at mission relevant speeds & scale

DG Recommendations for USG Support

Spatial

- **Need USG help re: the relaxation of spatial resolution and data collection restrictions**
  - Including 3.7m for SWIR deliverables
  - Allow the ability to collect SWIR data globally and not just certain areas of the globe
  - 15-20cm is another standard for imagery globally and the USG should consider aspects for spatial resolution relaxation
- **Some commercial satellite imagery firms are resampling imagery from 80cm to 50cm**
  - The USG could help industry by maintaining MTF targets for sub-meter resolution and NIIRS interpretation.

DG Recommendations for USG Support

Spectral

- **USG can continue to assist in maintaining programs for radiometric calibration including SWIR**
  - USG should continue to offer access to test/cal-val ranges; control data, DEMs etc. for satellite collection

Temporal

- **DigitalGlobe will be introducing new revisit capability with inclined orbits**
  - The USG could help to initiate a Study with universities to ensure the image quality for mapping and spectral analysis missions and what parameters can specifically help with programs such as USDA NAIP, USGS 3DEP, etc.

DG Recommendations for USG Support

Global support

- **When commercial firms introduce new technologies to the marketplace:**
  - Industry needs help from the USG to help expedite any required USG approval processes
  - Regulatory restrictions require us to severely degrade the quality of imagery for customers, despite having requested permission to sell full-resolution 3.7m SWIR imagery (for fire assessment, etc.) more than three years ago.
  - USG needs to put more focus on evaluating and adding these new technology products as alternatives to traditional methods that cost the U.S taxpayer multiple times as much.

- **Concept of cyber security**
  - Industry can benefit from better guidance from USG to insure that delivery of value-added information /output products cannot fall into the wrong hands leading to reverse-engineered;
  - What can USG do to help commercial data firms protect original source data?

- **The U.S. Census, USDA and USGS have global-focused missions**
  - Would be beneficial for USG agencies to help promote benefits of SWIR band technology and other commercial capabilities jointly.

- **Remote sensing has changed the concepts of map making**
  - The USG should help industry from being constrained by use of certified surveyors for imagery use.
  - The USG can continue to help by supporting independent evaluation of various sensors - both domestic and foreign sensors and imagery

Summary

- DigitalGlobe's imagery, platform, and analytic capabilities help to address USG and other global customer application needs and project requirements
  - DigitalGlobe satellite, aerial, and open-source data
  - High-speed, multi-partner processing ecosystem and crowd sourcing capabilities at massive scale (GBDX)
  - Variety of high-res, high-accuracy elevation products (Vricon, AES, AT3W)
  - Value-added analytic capabilities and information products
- DigitalGlobe stands ready to work with & support USG Agency program activity

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